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# Cleaning with Charcoal

## Turning Grape Juice into Water!

## Introduction

Activated charcoal is widely used in water purification—whether in municipal water treatment plants or in aquariums—to remove impurities and contaminants. Demonstrate the "cleaning action" of charcoal by decolorizing grape juice!

## Concepts

- Activated charcoal
- Adsorption
- Water treatment

## Materials

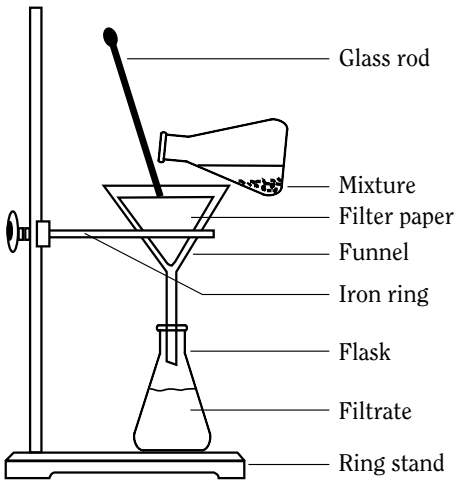
Activated charcoal, 3 g
Grape juice, purple, 90 mL
Balance
Beaker, 250-mL
Filter paper (to fit funnel)
Funnel, large, glass
Ring clamp and support stand
Stirring rod
Water goblet or Erlenmeyer flask, 125-mL
Weighing dish

### *Safety Precautions*

*Charcoal is a flammable solid. Any food-grade items that have been brought into the lab are considered laboratory chemicals and are for lab use only. Do not taste or ingest any materials in the laboratory, and do not remove any food items from the lab after use. Wear chemical splash goggles whenever working with chemicals, heat or glassware in the laboratory. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.*

## Procedure

1. Pour 90 mL of purple grape juice into a 250-mL beaker.
2. Using a balance, weigh about 3 g of activated charcoal into the weighing dish.
3. Add the charcoal to the grape juice and mix gently with a stirring rod for 1–2 minutes. Allow the mixture to stand while preparing the filtration setup (steps 4–6).
4. Set up a glass funnel with a ring clamp on a support stand.
5. Fold qualitative filter paper into a cone and place in the funnel.
6. Set a water goblet or a 125-mL Erlenmeyer flask under the funnel.
7. Carefully pour the grape juice–charcoal mixture into the funnel. Collect the filtrate in the flask.
8. The filtrate should be a clear and colorless liquid—all traces of color and odor are removed by the charcoal.



## Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The decolorized grape juice may be poured down the drain. Allow the charcoal filter to dry out, then dispose of in the trash according to Flinn Suggested Disposal Method #26a.

## Tips

- Transferring the grape juice from a wine glass into a water goblet (wine-to-water) may be more dramatic, but it is difficult to pour without dripping.
- In municipal water treatment plants, water is usually passed over a bed of activated carbon to remove contaminants. How much color can be removed by passing the grape juice once through a filter containing activated charcoal?
- Experiment with removing different kinds of colored impurities from water—try red food coloring, other fruit juices, copper(II) sulfate solution, iron salts, etc.

## Discussion

Activated charcoal (also called activated carbon) is obtained by the destructive (dry) distillation of wood or other plant and animal sources. The carbon residue obtained in this manner is "activated" by heating it with steam, oxygen or carbon dioxide. This process results in a finely divided solid with an extremely large surface area. The structure of activated charcoal is very porous (honeycomb-like) and thus has a high affinity for many substances, especially organic compounds, chlorine, and many gases.

Activated charcoal has been used since ancient times to remove undesirable contaminants from drinking water. Activated charcoal is an excellent adsorbent—a substance that is capable of attracting and binding the components of a mixture. (Adsorption refers specifically to the adhesion of atoms, ions or molecules onto the surface of another substance, usually a solid.) Because of its high adsorption capacity, activated charcoal is a critical component in all modern water and air purification systems. It is used to decolorize, deodorize, and clarify water. In this demonstration, activated charcoal removes natural organic indicator dyes that give grape juice its distinctive purple color and flavor.

The ability of activated charcoal to filter and remove contaminants from water depends on the particle size, surface area, and pore structure of the charcoal, as well as on pH, temperature, and the types of impurities.

## Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

***Unifying Concepts and Processes: Grades K–12***
Evidence, models, and explanation
Constancy, change, and measurement
***Content Standards: Grades 5–8***
Content Standard B: Physical Science, properties and changes of properties in matter
Content Standard F: Science in Personal and Social Perspectives; populations, resources, and environments
***Content Standards: Grades 9–12***
Content Standard B: Physical Science, structure and properties of matter
Content Standard F: Science in Personal and Social Perspectives, natural resources, environmental quality

## Reference

This activity was adapted from *Chemistry of Organic Compounds,* Vol. 19 in the *Flinn ChemTopic™ Labs* series, Cesa, I., Editor; Flinn Scientific: Batavia, IL (2006).

## Materials for *Cleaning with Charcoal* are available from Flinn Scientific, Inc.

| Catalog No. | Description |
|---|---|
| C0202 | Charcoal, Granular, Activated, 100 g |
| GP5050 | Short Stem, Fluted, Borosilicate Glass |
| AP3104 | Filter Paper, Qualitative, 12.5 cm |

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.

